**The Case of the Collapsing Can**

[](http://www.google.ca/imgres?q=crushed+can&hl=en&biw=1280&bih=605&gbv=2&tbm=isch&tbnid=zNmEkeJ5DOqn2M:&imgrefurl=http://www.rexam.com/winecans/index.asp?pageid=12&docid=g_pqPS0oziwLwM&imgurl=http://www.rexam.com/winecans/images/pictures/pho_crushed_can.gif&w=174&h=349&ei=uXw5T56ZB4nv0gGQx4TIAg&zoom=1)

**UNIT:** SCH3U – Gases and Atmospheric Chemistry

**BIG IDEAS**: Properties of gases can be described qualitatively and quantitatively, and can be predicted.

**Ministry Expectations: F2.2** determine, through inquiry, the quantitative and graphical relationships between the pressure, volume, and temperature of a gas [PR, AI]

**Introduction:**

This experiment shows that a can is crushed when the pressure outside is greater than the pressure inside, and the pressure difference is greater than the can is able to withstand.

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| **Materials:** | **Procedure:** |
| 2 aluminum cans (empty)  25mL graduated cylinder  Hot plate  Water  Bowl filled with ice water  Tongs  Goggles | 1. Measure out 15mL water with graduated cylinder and pour into empty can. 2. Place can on hot plate. 3. Boil the water in the can for approximately 1 minute (steam should be seen exiting the can). 4. Grasp the can with tongs and quickly invert it (mouth end down) into the bowl of ice water. 5. Repeat experiment as necessary. |

**Safety Precuations:** 1. Wear safety goggles, 2. Only handle the can using tongs, 3. Turn off the hot plate when not in use, 4. Do not place an empty can on the hot plate, 5. Students should be at a safe distance from the lab bench in case some boiling water spills.

**Results/Explanation:**

Before heating, the can was filled with water and air. By boiling the water, it changes states, from liquid to gas (water vapour). The water vapour (steam) pushes the air that was inside, out of the can. By inverting the can in water, we are cooling the vapour very quickly and constraining the potential for rapid flow of air back into the can. The cooling condenses the water vapour back to water. All of the vapour which took up the interior space of the can before is now turned into a few drops of water, which take up much less space. This causes the pressure inside the can to drop. The atmospheric pressure outside of the can is greater than the pressure inside the can, thus the can is crushed.

**Tips/Teachers Notes:**

1. What was in the can besides water? ***A. air***
2. What happens when water is boiled? ***A. Water turns to water vapour (gas)***
3. What happens to the air in the can as water vapour is formed? ***A. The air is pushed out***
4. What happens when the can is cooled? ***A. The water vapour condenses.***

**Collapsing Can Student Worksheet Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. **Predict what you think will happen when the can is inverted into the ice water bath.**
2. What was in the can to begin with, besides water?
3. What happens to water when it is heated? What happens to water when it cools back down? (Explain on a molecular level. You may draw the water molecules to help explain your answer).
4. At the instant that the can is inverted into the ice water, is there air inside the can? Explain.
5. Predict what you think would happen if I performed this exact same experiment on the summit of Mt. Everest.
6. **Consider these questions pertaining to the demonstration procedure:**
7. **Must the can be inverted?**
8. **Does the water in the bowl have to be ice cold?**
9. **Does the water in the can have to be boiling?**
10. **Can we get the same effect by not putting the can into a bowl of water?**
11. **Does the size of the can matter?**
12. **Does the material that the can is made of matter?**
13. **Does the amount of water in the can matter?**

**Pick one of the preceding questions and design an experiment that you could carry out in an attempt to answer your question. Make predictions regarding what you think the result of your experiment would be and why.**